ILLINOIS SOCIETY OF PROFESSIONAL ENGINEERS — FOUNDED 1886

the ILLINOIS ENGINEER

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS — FOUNDED 1934

CENTRAL ILLINOIS CHAPTER SIGNS NUMBER 50
(photo by Pfile, Decatur, Illinois)

THE ILLINOIS ENGINEER, NOVEMBER, 1956—VOLUME XXXII, NO. 11

ILLINOIS SOCIETY OF PROFESSIONAL ENGINEERS, Incorporated

Affiliated with the National Society of Professional Engineers

BOARD OF DIRECTION

ROYCE E. JOHNSON, President (72)*

DWAIN M. WALLACE, Past President (72)

A. D. SPICER, Secretary-Treasurer (72)

A. W. NEUREUTHER, Vice President (72)

JOHN HENLINE, Ambraw (73)
L. D. HUDSON, Capital (72)
A. C. KESSELL, Capital (73)
HERMAN DORN, Central Illinois (73)
C. DALE GREFFE, Champaign County (72)
BEN F. MUIRHEID, Champaign County (73)
JOHN DOLIO, Chicago (72)
H. F. SOMMERSCHEILD, Chicago (73)

FRANK EDWARDS, Chicago (73)
FRANCIS WEIR, DuKane (73)
C. R. RISELING, Egyptian (73)
F. L. DUNAVAN, Illinois Valley (73)
W. S. GRAY, Joliet (73)
IRWIN R. LIETZKE, Lake County (73)
J. D. VOORHEES, Madison (73)
KARL A. BRUGGER, Peoriarea (73)

ARNOLD LUNDGREN, Rockford (72)
H. H. CORDES, Rock River (72)
A. J. FEICKERT, St. Clair (73)
L. S. PAPPMEIER, West Central (72)
C. W. KLASSEN, N.S.P.E. Nat'l Director (72)
W. W. WALLACE, N.S.P.E. Nat'l Director (72)
K. C. HOEGLUND, Chairman I.E.C. Representatives (74)

P. E. ROBERTS, Executive Secretary

H. E. BABBITT, Secretary Emeritus

* Refer to Annual Meeting at which present term expires.

ILLINOIS ENGINEERING COUNCIL REPRESENTATIVES

K. C. HOEGLUND, Chairman, L. K. CRAWFORD, JOHN G. DUBA, J. D. VOORHEES

CHAPTER OFFICERS FOR 1956

CHAPTER	PRESIDENT	VICE-PRESIDENT	SECRETARY-TREASURER	CHAPTER REPRESENTATIVES
Ambraw	Charles L. Dees	I. C. Bliss	B. P. Johnson	John Henline
Capital	A. A. Thorsell	R. Dean Collins	Verdun Randolph, Sec'y Emmons Patterson, Treas.	L. D. Hudson, A. C. Kessell
Central Illinois	John Housiaux	J. Parke Boyer	Walter D. Hays	Herman Dorn
Champaign County	Edward R. Healy	Gordon V. Carlson	Wendell F. Kent	C. Dale Greffe, Ben F. Muirheid
Chicago	Alois W. Graf	John G. Duba	Linas H. Brown	John Dolio, H. F. Sommerscheild, F. W. Edwards
DuKane	Richard Thornton	Noel Thomas	John J. Fast	Francis Weir
Egyptian	Paul O. Hall	Donald E. Ball	Frederick H. Persson	C. R. Riseling
Illinois Valley	Casimir J. Chamlin	Francis E. Sexton	R. A. McClevey	F. L. Dunavan
Joliet	Lloyd C. Gilbert	Robert A. Brown	Howard Hassert, Sec'y Bernard Anderhous, Treas.	W. S. Gray
Lake County	William T. Hooper, Jr.	Urban C. Neyer	K. E. Welton, Sec'y R. A. Rasmussen, Treas.	Irwin R. Lietzke
Madison County	H. V. McCoy	R. B. Dunlap	E. N. Juneau	J. D. Voorhees
Peoriarea	Tom N. Landes	Paul L. Zumwalt	Oscar Frost	Karl A. Brugger
Rockford	John G. Duguid	John K. Grubbs	Bertil T. Anderson	Arnold Lundgren
Rock River	C. C. Clausen	R. H. Renwick	A. W. Osterling	H. H. Cordes
St. Clair	Manuel Garcia	Philip Bauer	Stanley Petraitis	A. J. Feickert
West Central	Melvin L. Toepke	Harry E. Chapman	Claude F. Bates	Louis Pappmeier

COMMITTEE APPOINTMENTS FOR 1956-57

BOARD OF DIRECTION COMMITTEES

Executive Committee
Royce E. Johnson, Chairman, A. W. Neureuther, A. D. Spicer, Wayne Wallace.

Honorary Membership
Dwain Wallace, Chairman, Russell E. Gibbs, Titus LeClair.

Illinois Award
William S. Gray (72), Chairman, Robert M. Roy (72), Raymond G. Brichler (73), Russell E. Gibbs (73), R. E. Greenfield (74), Merton Memler (74).

SOCIETY COMMITTEES

Advertising
W. A. Russell, Chairman. William H. Jacobs, Robert M. Roy, Fred Persson, E. D. Antrobus, Howard F. West, M. L. Graham, T. N. Landes, F. L. Petitti, Philip Bauer, J. B. Stall, Ernest Storer.

Budget and Finance
A. W. Neureuther, Chairman, Royce Johnson, A. D. Spicer, C. Dale Greffe.

Civil Defense
V. E. Gunlock and C. W. Klassen, Co-Chairmen, R. E. Hedgecock, John Doak, W. A. Rakow, L. J. McGonigal, Burt K. Preston, H. V. McCoy, L. P. Murphy, Robert H. Anderson, C. F. Manion, Jr.

Constitutional Amendments
J. H. Morgan, Chairman, Sidney Danoff, Frank Edwards, J. R. Gardner, O. W. Irwin, L. J. Keenan, F. L. Dunavan.

Cooperation with Illinois Architects
J. Ray Carroll, Chairman, John Bleck, James E. Chiaro, James G. Cooney, J. Philip Dahlberg, Gerald M. Marks, Rodney Spangler, J. D. Voorhees.

Ethics and Practice
George DeMent, Chairman (72), C. Dale Greffe (73), Robert Renwick (73), Cliff Abraham (74), John F. Sweetnam (74), Virgil I. Dodson (72).

Fees and Salaries
Linas H. Brown, Chairman (72), Dale V. Hammond (72), Frederick Friedewald (72), Lawrence C. Auby (73), A. W. Neureuther (73), L. K. Crawford (73), Gordon V. Carlson (74), Howard Verduin, Kenneth R. Wood.

Legislative
George L. Farnsworth, Jr., Chairman, R. W. Wallace, Herman W. Dorn, Arthur M. Ferenz, Alois W. Graf, Gilbert Henning, Arthur Kaindl, Roy Kastner, Harry A. Kluge, Silas Cartland, Dale Hammond, Warner Johnson, Elmer Knight, Arnold Lundgren, James J. McNally, Charles R. Roberts, G. E. Rynearson, Francis E. Sexton, Leo Spurling, C. A. Walls, C. K. Willett, R. Dean Collins.

Membership
W. Kenneth Waltz, Chairman; Raymond G. Brichler, George Chlebicki, Robert E. Schwartz, Regional Chairmen; Irwin C. Bliss, Leslie Ryburn, Gordon V. Carlson, George M. Booth, F. S. Weir, Donald Ball, Richard L. Poling, Robert A. Brown, A. G. Adams, L. P. Murphy, John K. Grubbs, Colin Schroeder, Melvin Dobbs, Robert F. Korsmo, Joseph West.

Past Presidents
Dwain Wallace, Chairman, C. W. Klassen, Raymond G. Brichler.

Professional Education
Russell E. Gibbs, Chairman, M. E. Amstutz, William L. Everitt, Walter E. Hanson, Robert K. Holloway, Frederick J. Meek, Joseph Seliber.

Publications
Ben F. Muirheid, Chairman Bonnell H. Allen, William H. Jacobs, M. H. Kinch, Verdun Randolph.

Public Interests
John Henline, Chairman (72), Leo Koberlein (72), Burton A. Scheidt (72), Robert M. Roy (73), A. W. Kerr (73), Warner Johnson (73), Stephen C. Casteel (74), Harry Chapman (74), John B. Stall (74).

Public Relations and Publicity
Robert M. Roy, Chairman, John W. Gee, W. J. Roberts, William Jacobs, Fred Persson, R. E. Waite, Sanger Westphal, Malcolm Graham, Harold B. Ratcliff, Clarence Wilson, W. M. Swanstrom, Philip Bauer, Harry E. Chapman.

Resolutions
James Morrow, Chairman, D. S. Magowan, J. P. Murphy, R. C. Peppers, Burton A. Scheidt.

State Building Code
Raymond W. Harrington, Chairman, Charles N. Debes, John Dolio, Loren Krause, C. T. Morrisett, Kenneth Welton.

State Engineering Employees
Elmer Knight, Chairman, Walter B. Worsham, Oscar Frost, Ellis Danner, C. E. Holtman, Frank L. Dunavan.

U.S.G.S. Mapping
Max Suter, Chairman, G. H. Dell, J. A. Dragesvich, Clifford Missman, Max C. Seiberling, J. E. Weinel.

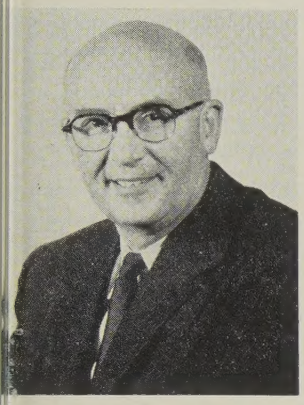
ILLINOIS ENGINEER: P. E. ROBERTS, *Editor;* C. DALE GREFFE and W. J. ROBERTS, *Associate Editors.*

Of Interest to I. S. P. E.

MESSAGE FOR NOVEMBER

by Royce E. Johnson, President

The statement "ISPE and NSPE are controlled by management men or executives" is occasionally made by dissatisfied members as well as by non-members who are asked to join.



President Johnson

The statement is usually true and fortunately so.

Engineers properly are identified with management, whether executives, administrators, department heads, staff engineers, operating, production, design, development or sales and service engineers. Their activities are so related, objectives so similar and interdependent and welfare so closely interwoven that a professional society that is good for one is good for all.

A contrary view imples that our professional societies should exclude men in management positions because their interests differ from those of engineers in inferior positions and that the latter should be antagonistic toward management.

Analysis of the duties and opportunities of any employed engineer, whether in sales, service, production, design, development, testing or research, will show that he represents and works for management. Further analysis will generally show that most young engineers feel that they have managerial potential or aspirations. Observation reveals that many engineers become managers. If the engineer cannot conscientiously perform his work and feel that he is carrying on a socially useful function when he is serving management he should seriously consider a change in employment.

What opportunity better than presented by ISPE can a young engineer find outside of his job to become acquainted with the successful engineers in a variety of occupations and positions? And where can he find a more practical organization in which to gain poise, experience in committee work and managing an organization?

Observe the engineers who were active for a number of years in their technical and professional societies and you will find that this participation helped develop their self-confidence, speaking ability and executive ability. Is this not a good return on the relatively small amount paid for dues? Add to this what NSPE and the affiliated state societies have accomplished for their profession, unobvious though it may be to many, and we find for all engineers tangible and intangible returns.

Further substantial increase in membership will materially increase the rate of returns.

Abe Lincoln's Prayer

"If you wish, I'll speak a prayer," said Abe Lincoln when he found a family he knew camped on the Illinois prairie en route to the West. A small son of the family was seriously ill. As Robert Sherwood tells the story in *"Abe Lincoln in Illinois,"* Mr. Lincoln took off his hat and reverently said:

"O God, the Father of all living, I ask you to look with gentle mercy upon this little boy who is here, lying sick in this covered wagon. His people are traveling far, to seek a new home in the wilderness to do your work, God, to make this earth a good place for your children to live in. They can see clearly where they're going, and they're not afraid to face all the perils that lie along the way. I humbly beg you not to take their child from them. Grant him the freedom of life. Do not deny him his birthright. Let him know the sight of great plains and high mountains, of green valleys and wide rivers. For this little boy is an American, and these things belong to him, and he to them. Spare him, that he too may strive for the ideal for which his fathers have labored so faithfully and so long. Spare him and give him his father's strength—give us all strength, O God, to do the work that is before us. I ask this favor, in the name of Your Son, Jesus Christ, who died upon a cross to set men free. Amen."

CONTENTS OF THIS ISSUE

READ THE ADVERTISEMENTS

SUBSCRIPTION RATES

$2.00 per year in advance to members of the Illinois Society of Professional Engineers. $4.00 per year in advance to non-members in U.S.A. and its possessions, Canada, and Mexico. Foreign $6.00. Single copies 40c.

Published by the Illinois Society of Professional Engineers, Inc., at 614 East Green Street, Champaign, Illinois.

Address all communications to the Illinois Society, P. E. Roberts, Editor, 614 East Green Street, Champaign, Illinois.

The Illinois Society is not responsible for statements made or opinions expressed in this publication.

Entered as Second Class Matter April 27, 1949, at the Post Office, Champaign, Illinois.

Vox Secretarii

By: P. E. Roberts, Executive Secretary

Thanksgiving

All of us have much to be thankful for every Thanksgiving. However, the Illinois Society has reason to be particularly grateful this year for the outstanding work done by Central Illinois Chapter under the leadership of its President John Housiaux and its Membership Chairman, Robert Schwartz. For that reason, it seems fitting and proper to use the picture of the signing of the 50th member of the Chapter during 1956 on the cover.

The Society is also thankful for:

the industry and sincerity of the State officers;
the faithfulness and loyalty of its Chapter Representatives;
the diligence of its Chapter Presidents;
the hard work of its Chapter Secretaries, and
the persistence of its Membership Chairmen.

May the Society continue to show a solid, healthy growth and may its sphere of influence continue to expand.

Membership

Membership totals for 1956 have an excellent chance of topping all previous totals. More than any other one period in the last several years, more members are taking an interest in obtaining new members for the Society. You are reminded of Illinois Society's Constitutional Article 6, Section 3, which states that persons admitted to membership after December 1 "shall be credited with payment of dues for the following year." If your prospective member is bargain-minded, you can offer him thirteen months' membership for twelve months' dues.

Iron Ore

The article by Dr. Walter Voskuil should be of particular interest to the members of the Illinois Society, for the reason that iron ore is one of the few basic commodities of interest to all engineers.

The reason for mentioning it in this column is that the Editor is desirous of obtaining your comments on this kind of material for publication in the Illinois Engineer.

Items of Personal Interest:

President Royce Johnson became a grandfather in October. He is slightly behind your Editor, who boasts of two grandsons, one a year old and one seven months.

Secretary Babbitt "keeps his finger in." He wrote for and received absentee ballots for himself and Mrs. Babbitt for the November 6th Presidential election.

National Director and Mrs. Wayne Wallace attended the Fall NSPE Board of Directors meeting in White Sulphur Springs, West Virginia, October 25th and 26th.

Past President George E. Ekblaw read a paper before the Geological Society of America in Minneapolis, Minnesota October 31st.

CENTRAL ILLINOIS CHAPTER SIGNS UP FIFTIETH APPLICATION THIS YEAR

The Central Illinois Chapter of the Illinois Society of Professional Engineers proudly announces receipt of its fiftieth application for membership since the first of the year. The fiftieth new member is Robert Briscoe, engineer for the J. L. Simmons Company of Decatur.

In the picture, Mr. Briscoe, seated in center, fills out his application for state and national membership under the watchful eyes of John Housiaux, Chapter President standing at the right, and Robert Schwartz, Chairman for the Membership Committee for the Central Illinois Chapter and for the Central Area Region.

After jumping off to a good start in the spring by winning a membership drive contest with the Champaign County Chapter, continued efforts of the Committee through the summer have resulted in: fifty new chapter members since January 1 of which thirty-three are of the National grade; a net gain of more than one-third in chapter membership; and the largest gain in membership, either in number or percentage, of any chapter in the State.

The Central Illinois Chapter, which is now the second largest in Illinois and exceeded only by the Chicago Chapter, is justly proud of our society and particularly of our membership chairman and committee. We believe much of the success of our membership drive can be attributed to Chairman Bob Schwartz, whose comment when asked to pose for this picture was, "Why take it now? We're not done yet. We still have prospects that we will sign up before the end of the year."

COVER PICTURE

The picture on the cover shows Robert A. Briscoe signing the 50th application blank received by Central Illinois Chapter during 1956. Robert E. Schwartz is at the left, Membership Chairman, and John Housiaux, President of the Chapter, is standing at the right.

Little Ralph was on the losing end of a marbles game. In a fit of anger, he threw his marbles on the ground, stomped his feet and started hollering.

"Do you know what happens to little boys who display their tempers like that over a simple marbles game?" his mother asked.

"Sure," answered Ralph. "They grow up to play golf."

One good thing about being a poor speaker: you don't have to worry about having an "off" night.

The Strategic Position of Iron Ore in the Economy of the Atlantic Basin Nations*

by Walter H. Voskuil †

Abstract

Supplies of iron from domestic ores or from neighboring countries are no longer adequate to meet the needs of the industrial nations in North America and western Europe. Supplementary supplies must be obtained from more distant sources that usually involve ocean transportation. Numerous iron ore deposits are available and are being exploited in Latin America, North America, Africa, and northern Europe, as sources of the supplementary requirements of the iron ore consuming industrial nations on both sides of the North Atlantic basin.

Among the several iron ore deposits, four, and possibly five, have ore of high iron content in adequate quantities to justify expenditures on ore-handling and shipping equipment for large scale operation. The use of large vessels to effect economy in the ocean transportation of ore helps make it commercially feasible to use these distant ore bodies at Wabana, Labrador, Cerro Bolivar and El Pao, Minas Geraes, and Kiruna and Gallivare in Sweden. Conakry in Africa may also prove to be of some major significance.

The high-phosphorus ores of Sweden are of particular significance to western European iron manufacturers where the basic bessemer process is important. The economic usefulness of the unusually high-grade ore deposits of Brazil is vitiated by the high inland transportation costs and the long ocean haul to European and United States' markets.

* Presented at the annual joint meeting of the Blast Furnace and Coke Oven Association of the Chicago District and the Eastern States Blast Furnace and Coke Oven Association, Oct. 26-27, 1956.

† Dr. Voskuil is Mineral Economist, Illinois State Geological Survey, and Professor of Mineral Economics, College of Engineering, University of Illinois, Urbana.

ABOUT THE AUTHOR

Dr. Walter H. Voskuil is a Doctor of Philosophy graduate of the University of Wisconsin. He came to the staff of the Illinois Geological Survey in 1931 as its first mineral economist. He is also Professor of Mineral Economics in the Department of Mining and Metallurgical Engineering, University of Illinois.

During World War II he served as head of the research unit, solid fuels section, the Office of Price Administration, on leave from the Survey.

He has authored many monographs and he has contributed to scientific journals. Four books on economic and mineral subjects have been authored by him. He is a member of several technical and social societies.

North Atlantic Nations

The North Atlantic Ocean is the world's busiest and most important main street. On each side of this main street are industrial nations which together produce 70 percent of the world's basic industrial raw material—pig iron.

For purposes of this discussion these nations comprise United States and Canada, the United Kingdom, and the European Coal and Steel Community.

The industries of the North Atlantic Basin nations were founded and built, in the main, on domestic supplies of ore, or ores obtained from nearby neighbors. These domestic supplies of ore are now being supplemented, in increasing amounts, from sources in Latin America and Africa. This is partly a matter of necessity and partly a matter of economics.

The nations in question are highly industrialized, they have each developed a certain degree of specialization in manufacture, and have come to depend upon one another economically. They interchange food products, textile raw materials, ores, fuels, manufactured goods, and transportation services.

The economic pattern that these nations have developed can be sustained and expanded only so long as they can get ample supplies of iron.

This need for iron ore has brought about an increasingly important economic role in the Atlantic Basin economy for the continents of South America and Africa from whom the additional iron ore must come. To their long-time role of supplying industrial raw materials—copper, oil, nitrates, bauxite, iron ore—to the industrial north, is the added possibility of industrial development based on their own vast deposits of iron ore. If this happens, it is almost a certainty that these nations will depend upon North America or Europe for coking coals as well as for industrial machinery and equipment.

With this brief sketch, we propose to examine the iron ore supply and requirements of the Atlantic Basin nations from the broad scope of the entire area instead of from any one nation's point of view.

Iron Ore Supplies of the Atlantic Basin Nations

Because domestic ores are and will remain the principal source of iron for the North Atlantic industrial nations, even though supplemented by imported ores, it is convenient to differentiate three groups of ores: 1) ores dominantly for North American industry; 2) ores dominantly for West European industry; 3) ores available for the North Atlantic international market. In figure 1 this third group of ores is shown within the enclosed line.

Within the area of ores that supply the international market, are the subgroups: 1) the Canadian deposits of Labrador-Quebec and the Wabana deposits in Newfoundland supply ore to both western Europe and the United States; 2) the deposits in Sweden, Norway, and Spain supply the European Coal and Steel Community countries and the United Kingdom, in addition to which Sweden also supplies the United States; 3) the third group includes the African and South American ores which export a high proportion of their output both to western Europe and North America.

The estimated reserves of iron in these groups of deposits, expressed in terms of the metal, are summarized in table 1.

TABLE 1

Reserves of Iron, as Metal,[a] in Principal Supplying Districts

Region or district	Millions of tons	
Labrador-Quebec, Newfoundland	2,200	
Sweden	1,513	
Spain	511	2,115
Norway	91	
North Africa	212	
Brazil	7,500	
Venezuela	1,430	9,045
Chile	115	
West Africa, estimated	600	

[a] Source: United Nations Survey of World Iron Ore Resources, Chap. 2, pp. 19-39, 1955.

The iron supply of the United States, as of 1955, is given in table 2. In that year nearly 21 percent of our total metal was received from foreign sources. We depended principally for imported ore on Canada and Venezuela which together supplied about three-fourths of the imported metal. Imports from other sources were in part based upon special grades of ore or corporate connection on the part of steel mills.

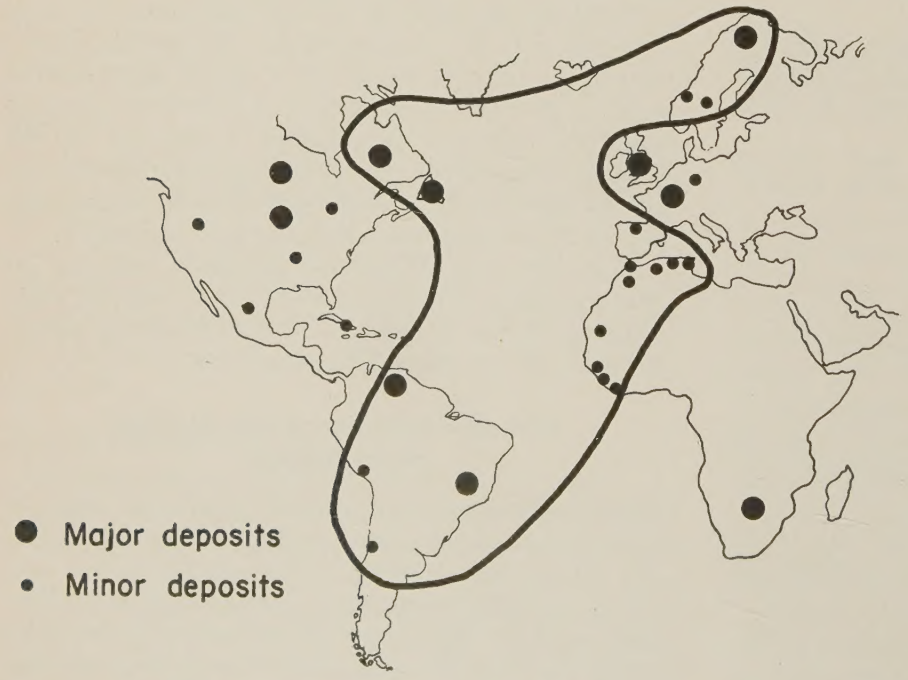
TABLE 2

Iron Supply of the United States in 1955, in gross tons

	Ores (thousands)	Percent iron content	Approx. content iron
Domestic iron ore shipments	107,388	49.5	53,157,060
Canada	10,072	54.5	5,489,289
Venezuela	7,120	64.0	4,556,941
Peru	1,554	56.0	870,296
Sweden	1,221	60.0	732,800
Chile	1,058	63.5	672,400
Brazil	1,010	68.0	686,887
Liberia	927	68.0	631,031
Mexico	176	68.0	119,879
British W. Africa	137	60.0	82,619
Dominican Republic	101	65.0	66,257
Cuba	40	40.0	16,078
Algeria	20	52.0	10,532
United Kingdom	2	30.0	623
Total			67,092,692
Percent imported			20.8%

The source of Europe's new iron supply in given in table 3. The United Kingdom and the European Coal and Steel Community nations (Belgium, France, Western Germany, Italy, Luxembourg, and the Netherlands) together obtain about two-thirds of their iron supply from domestic sources. The principal outside source is Sweden. Contributions from several African sources are 10 percent and shipments from Brazil are negligible.

The United Kingdom is dependent upon imported iron to a greater degree than either the United States



IRON ORES IN THE ATLANTIC BASIN ENTERING INTERNATIONAL TRADE

TABLE 3

Europe's Source of Iron, 1951 [a] (thousands of metric tons)

	Ore production	Percent iron in ore	Produced or imported as iron	Percent
ECSC				
United Kingdom	15,014	30.0	4,504	
Belgium	79	27.9	22	
France	35,201	33.5	11,792	
West Germany	12,923	27.0	3,489	
Luxembourg	5,625	27.9	1,569	
Netherlands, Saar		33.5		
Total			21,376	65.0
Iron shipped in				
Sweden	12,404	60.0	7,442	22.6
Spain	1,489	44.5	663	
Yugoslavia	281	50.0	141	
Total			8,246	25.0
Brazil	132	68.0	90	0.2
Algeria	2,387	52.0	1,241	
French Morocco	545	45.0	245	
Sierra Leone	1,169	60.0	701	
Spanish Morocco	959	66.5	638	
Tunisia	771	53.5	413	
Total			3,238	9.8
Grand Total			32,950	

[a] Bureau of Mines, Mineral Yearbook, 1953, preprint on "Iron Ore," p. 22.

or the nations of the European Coal and Steel Community. In fact, more than half of United Kingdom new iron supplies come from abroad. This is shown on table 4, "Source of Iron for the United Kingdom, 1954."

Two sources of imported ore, Sweden and French North Africa contribute 70 percent of foreign imports.

TABLE 4

Source of Iron for the United Kingdom, 1954 (thousand long tons)

	Ore production	Percent iron in ore	Iron content
United Kingdom	15,337.9	30.0	4,601.4
Newfoundland	997.0	51.0	508.5
Sweden	3,541.8	60.0	2,125.1
France	712.8	33.5	238.8
Spain	513.9	44.5	228.7
Spanish Morocco	245.6	66.5	163.3
French N. Africa	2,702.8	52.0	1,405.5
Sierra Leone	675.1	60.0	405.1
Total			5,075.0
Grand total			9,676.4
Percent imported			52.4%

Summary of Post World War Ore Movements

The importation of ores by industrial nations is assuming significant proportions and will apparently continue in the future. The largest imports are of high grade ore. Fifty-four percent of ore imported by the United States is 60 percent grade or higher. Likewise, 77 percent of ECSC's iron ore imports are of 60 percent grade or better and 66 percent of the United Kingdom's imports. In the important intercontinental movements of ores, only the rich ores can bear the heavy cost of long distance transport.

Ocean distances in nautical miles from principal sources to principal consumers are about as follows:

To the United States from

Brazil	4,900
Chile	4,600
North/West Africa	4,000
Sweden	4,000
Venezuela	2,180

To Europe from

Brazil	6,270
Newfoundland	2,500
North Africa	1,990
Scandinavia	1,250
Sierra Leone	3,420
Spain	930
Venezuela	3,650

With distances ranging from 2,000 to more than 6,000 miles, transportation costs become critical. To effect economies in transportation, barge ore carriers of 31,000 tons DWT are being built for trans-Atlantic and coastal service. In 1956, a combined ore and oil carrier was put in service with a capacity of more than 50,000 tons of either iron ore or petroleum. In the matter of transportation costs, it is obvious that ore deposits on or near tidewater have a distinct advantage over deposits in interior locations.

Although 14 countries and 19 mining districts in the Atlantic Basin contribute to the ore needs of the industrial nations in North America and western Europe, five major ore bodies, because of the large size of the deposits and high grade of ore, are of significance in future long-time ore calculations. These are: 1) the Swedish deposits at Kiruna and Gallivare; 2) Labrador-Quebec; 3) Wabana; 4) El Pao and Cerro Bolivar in Venezuela; and 5) the Minas Geraes region in Brazil. Peru may probably be entered in this list if major ore discoveries justify it.

Among other producers and exporters of ore, principally those districts in northern and western Africa, the reserves are so limited that we cannot expect production to be expanded and productive life will also be short. Only Algeria appears to have a reserve that gives promise of a sustained output at current levels.

Ore consumers on both sides of the Atlantic are now drawing from common sources in Labrador, Venezuela, Sweden, Algeria, Sierra Leone and Tunisia. As between the two groups of consumers on opposite sides of the ocean, the Europeans have the more serious physical and financial problems. Consumers in the United States have a financial interest in the Labrador-Quebec and also the Venezuelan ores, and these source areas are favored by short transportation routes.

In ECSC countries and the United Kingdom, iron ore output has been more or less stationary since 1910, rarely exceeding 100 million tons. With the exhaustion of the richer ores, never very abundant, these countries now draw heavily on foreign ores in order to obtain

suitable blendings. These imported ores come chiefly from Sweden, Spain, and North Africa. Recently, imports have come also from west Africa and America.

The present pattern (table 4) shows that the United Kingdom and ECSC countries of continental Europe obtain two-thirds of their new iron locally from low-grade ores present in these countries. France ships its surplus iron ore to Belgium, Luxembourg, West Germany, and the Saar. Shipments from Sweden and other European nations bring the total inter-European receipts of new iron up to 90 percent. Africa contributes practically all the remainder. Brazil and Venezuela are making token shipments.

In this pattern of European ore supply, the position of Sweden is unique. The typical properties of high iron content, high density, and low gangue reduce the space required for shipping. Even more important than the physical properties of Swedish ore is the high phosphorus content of much of the Swedish ore.

"Because phosphorus can not be removed from pig iron which is refined into steel in the acid or silica lined converter, the amount in the finished steel must be controlled by the selection of low phosphorus raw materials, particularly the iron ore. All of the phosphorus in the charge enters the pig iron. On the contrary, phosphorus can be slagged off in basic lined Thomas converter. In fact, Thomas pig iron normally contains from 1.5 to 2.0 percent phosphorus to supply heat during the latter stages of refining. This requires ore ranging from 0.75 to 1.0 percent of phosphorus depending upon the iron content of the burden and in turn the number of tons of ore per ton of pig. Under current European practice, ore containing in excess of 1.0 percent of phosphorus is desirable because it can be used as a "Sweetener" thus making it possible to use medium or low phosphorus ore in the production of Thomas pig iron. The marked extent to which Europe utilizes the Thomas process is shown in table 5. In brief, the high phosphorus content of certain grades of Swedish iron ore is a distinct advantage in marketing such ore in Europe." (Joseph, 1954.)

TABLE 5

Steel Production in Western Europe in 1952 (Coheur and Kosmider)

	Total steel production*	Basic bessemer	Percent basic bessemer
Luxembourg	3.302	3.238	98.0
Belgium	5.608	4.631	82.6
Saar	3.105	2.319	74.7
France	11.594	7.265	61.2
West Germany	17.387	7.630	43.8

* Thousands of tons per annum.

The high phosphorus Swedish ore is blended with domestic ore and other imported ores. Germany, for example, currently obtains about one-third percent of its iron from Sweden, another third from domestic ores, and the remainder, in varying quantities, from 16 other countries in Europe and Africa. Germany nevertheless is one of the large consumers of Swedish ore because the total output of steel is relatively large and about 44 percent of the steel produced is made by the basic Bessemer process. Although less steel is produced in Belgium, Luxembourg, and the Saar than in Germany, the former countries produce a larger portion of their steel by the basic Bessemer process. As a result, almost 90 percent of the ores imported from Sweden are high phosphorus ores.

In addition to supplying phosphorus for the basic Besssemer ovens, Swedish ore is very desirable because of its high iron content which reduces slag volume and coke consumption.

The growing output of Swedish iron ore, especially since 1950, reflects the increasing drafts upon this ore by both the United Kingdom and ECSC nations. The practical limit to the tonnage of Swedish ore available is the capacity of the docks at Narvik, Norway, which is about 15 million tons annually.

The quest for additional high grade ores, at possibly lower cost, extends also to west Africa and the Americas. In the case of the African ores, the difficulty common to practically all the ore districts is the limitation of the size of the reserve. This factor precludes the economic feasiblity of capital expenditures in enlarging port and rail transportation facilities in order to expand shipments. Exceptions to this are the relatively large known deposits in Algeria and the less well explored deposits in West Africa in the vicinity of Conakry.

From current sources, then, the limits of available ore for western Europe are set by the capacity of the Swedish mines and the port facilities of Narvik and the capacities of port facilities in north and west Africa.

Should demand for high grade ores expand beyond the capacity of the Swedish and African sources, the potential alternatives are Venezuela, Wabana, Labrador-Quebec, and Brazil. Each of these districts may be considered as having major size ore deposits.

An examination of each of these potential sources discloses their differential economic availability.

The Wabona ores are well situated for cheap ocean transport. This ore has a high silica content which prevents its wide use in the United States. The United Kingdom is the major overseas consumer although small amounts were shipped to Germany. This high phosphorus ore competes with like ores from Sweden to supply the basic Bessemer furnace and is not likely to expand in output against Swedish competition.

Labrador-Quebec, Venezuela, and Brazil, not restricted by chemical composition of ore, compete on a price basis, in which mining costs and transportation to European markets both figure. The average price in 1955 is reported as follows:

Source	Price per gross ton	Percent of iron	Price per 100 pounds of iron	Distance to Europe nautical miles
Brazil	$11.11	68.0	$0.73	6,270
Venezuela	6.37	64.0	0.44	3,650
Canada	7.85	54.5	0.64	2,600

The Special Problem of Brazil

The ore deposits of Brazil, in the State of Minas Geraes, rank among the largest in the world. Production is currently about 3.6 million metric tons of which about one and a half million tons is used in the domestic iron industry and the remainder is exported mainly to the United States, but also to Europe in small amounts.

The Brazilians are anxious to establish a domestic iron and steel industry and have succeeded to the extent of producing annually more than one million metric tons of pig iron and an equivalent tonnage of steel. This is the equivalent of 40 pounds per person per year. The principal steel plant is located at Volta Redonda on the railway connecting Rio de Janeiro with São Paulo.

Expansion of an iron and steel industry in Brazil is attended by two difficulties—high transportation costs of ore and inadequate coal supplies of poor quality.

The principal producing area, the Itabira district, is about 325 miles from the seaport of Victoria by way of the Victoria-Mines railroad. This railroad is of meter gauge and was laid out to avoid heavy earthwork and expensive bridges. The result is a very winding road with some steep grades.

Iron ores in the San Francisco Valley is served by the Central & Brazil Railroad which is 1.6 meters gauge from Rio de Janeiro to Belo Horizonte, with feeder lines of 1 meter. The distance is 300 miles. The Volta Redonda steel plant is on the broad gauge line of the Central railroad making connection at Entre Rios.

The proved coal reserves of Brazil are all in the southern provinces. Brazilian coal presents a very difficult problem being high in both ash and sulfur. It is generally found in many seams and small partings. The inclusion of these partings in the coal as mined presents a washing problem which, it is stated, is the most difficult known throughout the world (Price, 1953). With an allowable ash of 13 to 16 percent in the washed coal, it is possible to recover only 30 percent of washed coal, and the cost is therefore excessive.

This explains the economy of importing coal.* Unexplored coal fields are known to exist in the northern part of Brazil between the Xunger and Parnarba rivers but are presently inaccessible.

Santa Catarina coal, delivered to Volta Redonda, costs twice the price of imported coal, irrespective of quality, and as the latter contains only 5 percent ash, the real difference is greater. At Volta Redonda where 70 to 75 percent of pig iron is used in making of steel and where iron scrap is scarce and costly, the cost of pig iron determines the cost of the finished product. Coke represents 65 percent of the cost of pig iron, while the cost of coal, which accounts for 75 percent of the coke, represents 50 percent of the cost of pig iron. It is obvious, therefore, that a blast furnace could not be economically and efficiently operated in normal times with 100 percent coal (Colliery Guardian, Aug. 5, 1954).

Brazil will have to import more coal in the future to meet the growing needs of the National Steel Works at Volta Redonda. Brazil's opportunity to obtain coal from abroad is conditioned to some extent upon her ability to deliver iron ore to consumers abroad, thereby providing both a means of foreign exchange and also return cargo for coal carrying vessels.

Expanding iron ore exports is, in turn, conditioned upon transportation facilities which, in effect, are the key to the Brazilian iron ore industry. Were Brazil's iron deposits on the seaboard, millions of tons a year would be exported. They are, however, located several hundred miles inland, behind formidable mountain barriers. The Victoria-Mines railroad has been improved and its capacity stepped up to handle six trains of 20 cars of 50 tons each daily. On the basis of a 5-day week it handles approximately 1,500,000 tons annually (Vandenburg, 1952). The port of Victoria, the ocean terminus of the Victoria-Mines railroad, cannot handle ships of more than 10,000 tons and is, therefore, unsuitable as a large-scale loading point, which would demand ships of 20,000 tons or more. An adequate port site is available at Ara Cruz which would give a shorter railroad haul.

The Central Brazil railroad is already overloaded and its carrying capacity can be increased only by heavy expenditures for enlarged port facilities, additional trackage, and rolling stock.

"It will be necessary to improve rail and port facilities in order to ensure regular supplies of coal to Volta Redonda. With this object, and also to raise mineral export capacity from the Minas Geraes iron mines, it is proposed to build a port at Itacurussa, on the Rio de Janeiro coast, and connect it by rail to the Central of Brazil Railway at Japeri. This would cut out the overloaded railway section between Japeri and the Federal Capital, which cannot be conveniently amplified. The projects will probably be carried out in two stages. The first will provide for exports of 1 million tons of ore; the mineral ships bringing coal on the return trip. Export capacity would be raised later to 5 million tons or more.

An alternative project has been submitted to the government to build a special ore railroad from the iron mines of Minas Geraes to Augusto Pestana, on the crest of the mountain. A double conveyor belt would be constructed from the point in two parts. The first section, 30 miles long, would drop 2,600 feet to the National Steelworks at Volta Redonda. The second section, of 112 miles, would rise 700 feet to clear the coastal range, then drop 1,950 feet to the port of Angra dos Reis, on the coast of Rio de Janeiro. According to calculations, one side of a 36-inch wide double conveyor belt would transport 2,400 tons of ore per hour down the mountain. The other side would haul 800 tons of coal hourly from the port at Angra dos Reis. (Colliery Guardian, Dec. 17, 1953.)

* Coal imports from the United States in recent years, in net tons were: 1947, 1,468,312; 1948, 959,323; 1949, 681,838; 1950, 1,054,305; 1951, 1,026,952; 1952, 875,507; 1953, 812,804.

Fuel Supply

The American coal industry is now assuming a strategic role in sustaining a vigorous iron and steel industry in western Europe and in expanding the industry in Latin America.

European nations have been importing coal from the United States in varying tonnages since World War II. The year 1956 may prove to be the year of largest exports to date. On the basis of reports to the Secretariat of the Economic Commission for Europe by individual governments, the full development of iron and steel production in Europe is being impeded by a coke shortage. There appears to be no immediate prospect of overcoming this shortage except for continued imports from the United States. This is already causing difficulties in the balance of payments position of some countries. The economic position can only be made secure if the mounting imports of coal and oil also, is used to provide additional exports. This should not be difficult where fuel purchases are made in non-industrialized countries, but coal, at present is available only in North America.

Coal to Latin America

The United States has long exported relatively small amounts of coal to Latin American nations; Brazil has been the principal importer. Two of the South American nations, as previously indicated, have extensive deposits of high-grade iron ore. The Brazilian problem has been stated previously; the key questions are transportation, adequate means of obtaining foreign exchange, and a supply of coking coal, which, under present conditions must necessarily come from the United States. Venezuela is also initiating a local iron and steel industry based on the extensive iron deposits of Cerro Bolivar. Coal will be obtained from domestic deposits located at Naricual. A plant of 165,000 ton output is being planned. This is equivalent to about 60 pounds of steel per person. In terms of consumption in the United States this is very small. Future enlargements will depend upon a continued growth of the national income and an adequacy of coking coal supply. Little is known about Venezuelan coal deposits. Limited surveys have been made and although it is thought that several hundred million tons may be found, only some ten million tons have been actually proved. Samples taken have indicated the coal to be of high-volatile bituminous type, but not suitable by itself for producing a metallurgical coke of good quality (Price, 1953). Future economic growth of Venezuela will eventually require far more steel than is contemplated in the output of the proposed plant. This may involve new plant construction, more imports of raw steel, or both. As in the case of Brazil, the United States may be called upon to furnish coking coal to supplement domestic supplies. Financial aid may also be necessary. This brings up the controversial question of foreign aid.

Foreign aid, if it is to be useful, effective and in the interest of the United States must seek out the conditions under which a highly productive society can be built and, if these exist, it can aid in marshalling the forces that can bring a productive society to the functioning stage.

Any program which increases the iron and steel output of a Latin American nation will also increase her productivity, her purchasing power, and her economic ability to increase trade with maturely industrialized nations—the United States and western Europe.

References

Brazil's coal imports: Colliery Guardian, v. 187, no. 4842, p. 765, Dec. 17, 1953.

Steel in Brazil: Colliery Guardian, v. 189, no. 4875, p. 184, Aug. 5, 1954.

Joseph, T. L., 1954, Sweden's iron ore: Blast Furnace and Steel Plant, v. 42, no. 11 (Nov.).

Price, John D., 1953, Some aspects of Latin American coal reserves: AIME preprint, p. 6 (Sept.).

Vandenburg, Joseph K., 1952, Itabira is breaking its bottlenecks: Engineering and Mining Jour., v. 153, no. 7, p. 89 (July).

HUMAN ENGINEERING A NECESSARY PART OF AUTOMATION

Machines are becoming so complex that engineers who design them will have to place less emphasis on the output of the machines and pay more attention to making them easier and simpler to operate. This is the prediction of George A. Peters, Jr., engineer at the Picatinny Arsenal, Dover, New Jersey, writing in the October issue of *Mechanical Engineering*, official publication of The American Society of Mechanical Engineers.

The theme of his article is that machines are growing so complicated that they place a heavy strain on the men who operate them. At the same time, the consequences of an error in operation are becoming more drastic. For example, one man operating an entire automated chemical plant could do tremendous damage and cause great financial loss by a single mistake.

As a result, engineers will have to take "a realistic view" of the capabilities and reliability of the workers who will operate tomorrow's production lines, and design machines accordingly.

In the past, the *Mechanical Engineering* article says, the individual worker was considered the variable which had to adjust to the machine system. Now, however, "the transition of workers' operations from simple manual manipulations toward increasingly complex . . . and decision-making functions has stressed the need for design in terms of human capability and variability." He adds that engineers are being called upon to make even the simple human operations more "natural" for ease of machine operation and for customer sales appeal.

In order to answer questions posed by the need for simplifying machine operation, Mr. Peters writes, engineers will have to turn to "the new field of human engineering which draws its basic information from the older fields of psychology, anthropology, sociology, anatomy and physiology."

Basic courses in human engineering should be an integral part of the formal education of all engineers,

according to Mr. Peters. He adds that some means of communication should be established between the various groups interested in human engineering. He raises the possibility of forming a special professional organization which would be open to specialists in psychology, engineering, anthropology, physiology, sociology, medicine, mathematics, statistics, physics and anatomy as well as those engaged in the more or less similar applied sciences of biomechanics, engineering psychology, biotechnology, applied experimental psychology, psychophysiology, psychotechnology and ergomanics.

NEWS FROM CHAPTERS

Peoriarea Chapter held its September 11 meeting at Westbrook's Restaurant near Pekin, Illinois. President Landes introduced Mr. L. P. Murphy (N '49), U. S. Corps of Engineers, who gave a talk on the Hurricane Diana in 1955. Mr. Murphy had sound pictures of the damage caused by the hurricane.

Illinois Valley Chapter held its September meeting at the Pines near Streator, Illinois. State Senator Fred J. Hart and State Representative Carl Soderstrom each spoke to the Chapter on legislative processes in Springfield. Twenty-two members and eight guests were present at the meeting.

Capital Chapter met on October 22 at the Springfield Water Plant. A free buffet supper was held at 7:00 p.m. Prior to the supper the tours inspecting the new plant began at 5:30 p.m.

Chicago Chapter's October 18 meeting was held at the Chicago Engineers Club. Following a social hour and dinner, the Chapter heard Mr. Robert A. Sprecher, attorney, who discussed matters of Ethics and Grievances. Mr. Sprecher answered many interesting questions. It has been suggested that a brief of his remarks be used in a future issue of the ILLINOIS ENGINEER.

Central Illinois Chapter by-passed routine and held a buffet dinner dance in the Tunnel Room of the St. Nicholas Hotel on October 26. The dinner dance was co-sponsored by the Chapter and the Ladies' Auxiliary.

LADIES AUXILIARY MEETING

Champaign County Ladies Auxiliary met at the Coach and Cherubs, Champaign for lunch on Saturday, October 6th. President Mrs. Edward M. Anderson introduced Mrs. Kenneth West, Mrs. William Dolezal, wives of student engineer members. Several guests were introduced. Following a business meeting the 28 members and guests enjoyed an afternoon of cards. Mrs. Francis Inskip, Program Chairman, announced that the next meeting will be held on November 14th at the home of Mrs. J. W. Briscoe, Urbana, Ill.

TIME ZONE CHANGE IDEA

by: P. E. ROBERTS, Editor

The end of daylight savings time for 1956 came for most cities on October 28th. There is an easy way to eliminate the irritation of two different times which occurs in various parts of the country every summer. Should the Western boundary of the present Eastern Standard Time Zone be moved to a north-south line west of Minneapolis-St. Paul, Omaha, Kansas City, Dallas and Houston, and that line be also designated as the eastern boundary of the Mountain time zone, then the entire Central time zone would be eliminated. Furthermore, by combining Pacific time with Mountain time and Atlantic time with Eastern time, there would be only two time zones in the United States, namely Eastern and Western. It has been demontrated by use of double daylight savings time that time adjustments are not difficult for most people. Those most interested in promoting two time zones in the United States instead of four are the railroads, airlines, radio and television stations, news services and newspapers, business with several offices and distributing companies. The idea seems to be worthy of immediate detailed study.

Many husbands are second story men—their wives seldom believe the first one.

CONTRACTORS' DIRECTORY

PROGRAM
FOURTH ILLINOIS STRUCTURAL ENGINEERING CONFERENCE

December 3, 4 and 5, 1956

Illini Union Building
University of Illinois
Urbana, Illinois

MONDAY, DECEMBER 3

Morning

10:00 Registration

12:00 Welcome Luncheon

Afternoon Session—"Concrete Specifications"

Presiding—C. P. Siess

1:30 Review of Changes in ACI Building Code Requirements for Reinforced Concrete—Frank Kerekes

2:30 Ultimate Strength Design of Reinforced Concrete—Eivind Hognestad

3:30 Panel Discussion — Frank Kerekes, Eivind Hognestad, N. M. Newmark, I. M. Viest, N. Khachaturian

Evening

7:30 Informal Social Hour

TUESDAY, DECEMBER 4

Morning Session—"Steel Specifications"

Presiding—N. M. Newmark

9:00 Recent Revisions of the AWS Specifications for Welded Highway and Railway Bridges—LaMotte Grover

10:00 Basis and Evaluation of the Specifications for the Design of Steel Columns—T. C. Shedd

11:00 Panel Discussion — LaMotte Grover, T. C. Shedd, F. M. Masters

12:00 Luncheon

Afternoon Session—"High Strength Structural Steels"

Presiding—W. H. Munse

1:30 Problems in Fabrication and Erection of High Strength Steels—E. F. Ball

2:30 The Mechanical Properties of High Strength Steel and Their Influence on Design—J. A. Gilligan

3:30 Panel Discussion—E. F. Ball, J. A. Gilligan, F. M. Masters, F. H. Dill

Evening

6:30 Conference Dinner
Speaker—Dr. Kenneth McFarland (Courtesy General Motors Corp.)
Subject—"Ropes of Gold"

WEDNESDAY, DECEMBER 5

Morning Session—"Special Foundation Problems for Single Story Buildings"

Presiding—R. B. Peck

9:00 Foundation Problems of the Single Story Building—R. F. Wittenmyer

10:00 The Design and Construction of Grade Floors for Industrial Buildings—F. M. Mellinger

11:00 Panel Discussion—R. F. Wittenmyer, F. M. Mellinger, H. O. Ireland

12:00 Conference Adjourns

Registration Fee

The registration fee for this conference is $10.00 per person, payable at the time of registration. This fee does not include housing or meals.

Additional Information

For further information about this conference, please write to Mr. R. K. Newton, Supervisor of Engineering Extension, 725 South Wright Street, Champaign, Ill.

PROFESSIONAL DIRECTORY

I hold every man a debtor to his profession; from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto.

Sir Francis Bacon

Engineering Societies Personnel Service, Inc.

New York	Chicago	Detroit	San Francisco
8 W. 40th	84 E. Randolph	100 Farnsworth	57 Post St.

The following items are furnished by the Engineering Societies Personnel Service, Inc., a non-profit, self-supporting, personnel service sponsored by I. S. P. E., A. S. L. E., A. I. E. E., A. I. M. E., A. S. C. E., A. S. M. E., S. N. A. M. E., E. S. D., E. C. S. F., and W. S. E. Replies should be addressed to the nearest office.

Members of the societies shown above may publish a free advertisement on this page by registering at the nearest E. S. P. S. office. A weekly bulletin of Positions Open is available by subscription, at $3.50 a quarter for members and $4.50 a quarter for non-members.

PLACEMENT FEES: The service is operated on a co-operative basis, whereby those actually placed in positions by the Service pay a fee in accordance with the established placement fee rates, which is 4% of the annual salary to members and 5% of the annual salary to non-members. HOWEVER, MANY EMPLOYERS EITHER PAY FULL PLACEMENT FEE OR NEGOTIATE FEES.

MEN AVAILABLE

Ind. Mgmt. Engr. pref. metalworking, textile, aviation: age 36. Performed cost analysis, time study, wage incentive, purch. studies in product diversification, etc., material control, processing, estimating budgeting of prod., labor and materials. $8400. U. S. 695-IE

Des. or Dev. Mfg. metal working; 26. M.S. M.E. Dev. and des. new machines. Resp. for all engrg. calc. Performed much exper. shop work, dev. testing, tool des. and fabr. 2 yrs. as instructor in gen. engrg. drawing at Univ. $7200. U. S. 694-IE

Designer. Metal working; 38. B.S. M.E. 1 plus yrs. exp. design work on heavy machinery design, layout and detail sheet lifters and coil lifters, both hand and motor oper. 5 plus yrs. in research dept. Design and layout on new products and product improvement. $6700. Chicago only. 693-IE

Designer, electrical; 30. B.S. E.E. Designed elect. systems for vending machines. Prod. engrg. of aircraft alternators, dynamotors. 6 mo. testing lge. induction and synchronous machines. 6 mo. mech. des. of machines. $5500. Midwest-South-West. 692-IE

Estimator and Expediter. Construction. 27. B.S. C.E. Estimating cost of homes over $50,000. Handle entire project from signing of contract to completion. Investigate problems and recommend solutions. $5400. Midwest 691-IE

Chief Engineer railroad. 44. B.S. C.E. 16 yrs. in railroad work; 5 yrs. as supv. asst. in supv. of 5 supvs. and 500 empls. for maint. and construction of tracks, bridges and bldgs. on an oper. district. Surveys, layout, inspection. $8500. East-Midwest-South. 689-IE

Field Engr. Construction; 28. B.S. C.E. 2 yrs. expt. layout insp. and supv. of construction. Resp. for purchase and utilization of soil-testing and allied eqpt. Also acted as instrument man, party chief and some design work. $7800. 687-IE

Geologist. Petrol, minerals, ores; 33. B.A. Geol. 4½ yrs. petrol. explor. with oil field service companies serving oil companies in Texas, Louisiana, Calif., Utah and Rocky Mts. Specialized in formation logging techs. Chgo. or suburbs. 682-IE

Manager or Supervisor mfg. 44. H. S. plus 8 yrs. exp. as mgr. mfg. eng. 5 yrs. general foreman of mach. shop, toolroom, welding, sheetmetal and assy. line. 3 yrs. toolmaker. 5 yrs. as prod. machinist. $12,000. 676-IE

Engrg. Sales Representative-Manufacturer's Agent. Machine tool attachments; 25. B.S. M.E. Mfg. engrg. exp. tool design, process engrg. and sales exp. $500 mo. Chgo. 680-IE

Plant Engr. Mining, metals ind. 35. B.S. E.E. Give engrg. assistance to customers. Inspect lge. apparatus before energizing eqpt. such as lge. transformers, meters, metal-clad switchgears, relaying lge. electric shovels. Office and appl. eng. $8500. Midwest-West. 678-IE

Plant Engr. Sheet metal fab. 31. B.S. M.E. 5 yrs. staff engr. liaison between production engrg. and maint. dept. Estimating costs of installation and purchasing eqpt., layout and installation of eqpt. and improvement in production methods. $8000. Chgo. area only. 675-IE

Assistant Plant Engr. Chem. or metal working; 35. B.S. M.E. 5 yrs. exp. in project and plant engrg. 3 yrs. exp. in tool design. $650 mo. Midwest. 674-IE

Management or Sales. Paper. 34. B.S. M.E. Mechanical engr. exp. all phases plant and industrial engrg. in paper and board mills and box plant. Desires mgt. position in paper industry or sales opportunity with paper industry supplier. $10,000. Any loc. 673-IE

POSITIONS AVAILABLE

Project Engr. M.E. or E.E. Up to 57. 5 or more yrs. exp. designing elect. work such as washers or dryers. Duties: Designing and conceiving ideas and development work on laundry eqpt. or new products. Must be willing to live in town of about 10,000 pop. for a mfg. Sal. up to $12,000. Loc.: Ill. Empl. will pay the fee. C-5673

Project Engr. E.E. or M.E. 40-45. 10 or more yrs. exp. designing elect. work such as lighting or communications. Knowl. of highway or road const. desired. Duties: Supervising lighting, architects and landscapers for toll plazas for toll roads for a consultant. Sal. $9000-12,000. Loc.: Chgo. Empl. will pay the fee. C-5679

Sales Engr. Grad. chem. eng. or chemist. 32-40. 5 plus yrs. exp. in rubber adhesives and plastics. 2 plus years in sales. Knowl. of pressure sensitive tapes. Duties: Working from home, contacting tech. personnel in varied industries, using adhesives, rubber and plastics. Have established accounts. Continue on these and promote new business. 35% trav. 300 mi. radius. Car furn. Sal. $7000-$9000. Loc.: Chgo. Empl. will negotiate fee. C-5762

Sales. M.E. 25-38; 2 or more yrs. in industrial eqpt., of molding nature. Knowl. of plastics. Duties: Sales of plastic molding eqpt. to mfgrers. and pharmaceutical mach'y. 50% trav. Car req'd. For a mfgr. of special mach'y. Sal. $5000-$6000 plus exp.. Chgo. Empl. will pay the fee. C-5680

Machine Design. Some mech. 2 plus yrs. in auto. mech. des. Duties: Des. automatic pkg. and bakery mach'y. for a bakery prod. Sal. Up to $8400 dep. on exp. Loc.: Chgo. Employer will pay the fee. C-5753

Dir. of Research. Grad. chem. or chem. engr. Age abt. 40. 5 plus yrs. in top level res. Knowl. of bldg. products desirable. Duties: To head up Research Dept. in bldg. products field. Must be leader and able to take complete charge of research group. Sal. $15,000-$20,000. Loc.: Chgo. Empl. will pay the fee. C-5766

Production Process Engr. Mech. or metallurgical engrg. 5 yrs. exp. in resistance and fusion welding. Know processing and planning. Background in fusion and resistance welding, pref. on aircraft eng. metals. Duties: Tech. advisor in chge. of all phases of welding from production and engrg. standpoint for a mfr. and ass'y. of Turbo Jet Engines. Sal. $600-$700 mo. Loc.: Chgo. C-5769

Plant Engrg. Design Engr. C.E. 3-5 yrs. in structural des. pref. in heavy indust. Know civil and struct. engrg. Duties: Preparation of des. drawings for plant engrg. projects, struct. des. related to bldgs., foundations, cranes and allied eqpt. Duties also incl. survey and field work. For a mfr. and ass'y. of turbo-jet engines. Loc. Chgo. Sal. $500-$575 mo. C-5768

Automation and Spec. Machine Designer. Deg. pref., not nec. Age 35-60; 5 yrs. exp. Know diversified engrg. Duties: Board work basis—need best men—can use them from project engrg. down to draftsmen on special machine des. and lge. and small mach'y. For an engr. Sal. $100-$200 wk. Loc.: Chgo. Empl. will negotiate the fee. C-5770

Designer. Elect. Some E.E. 2 plus yrs. on board. Duties: All des. of small radio and TV transformers, des. of circuits and test eqpt. for a mfr. Sal. Up to $100 wk. Loc.: Chgo. Empl. will pay the fee. C-5772

Business Mgr. Age 30-40. In gen. business in bldg. supplies industry. Duties: Gen. mgr. and sales of mfg. plant in bldg. aggregate field abt. 25 employees. For a mgr. of bldg. mat. Sal. $800 plus profit. Loc.: Iowa. Empl. will pay the fee. C-5688